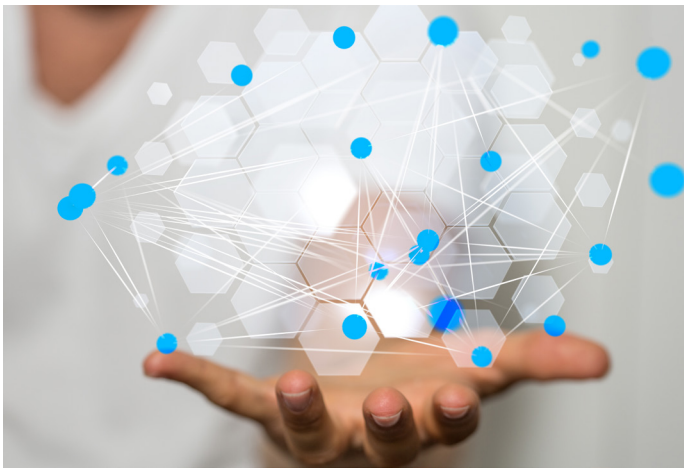
# Building a blockchain utility in healthcare

One goal of the Synaptic Health Alliance is to build a utility that benefits the health care system. The Alliance has deployed a multi-company, multi-site, permissioned blockchain utility. Unlike a public anonymous blockchain, the Alliance consciously chose to deploy a permissioned blockchain, a more effective approach, consistent with enterprise blockchains where identity and privacy are important.



## Architecture Principles

As the Alliance considered the architecture for our utility, we employed several foundational principles:

**Leverage open source** – Open source software benefits from a large community of contributors while protecting the Alliance from vendor lock-in and providing an option to make changes on our own.

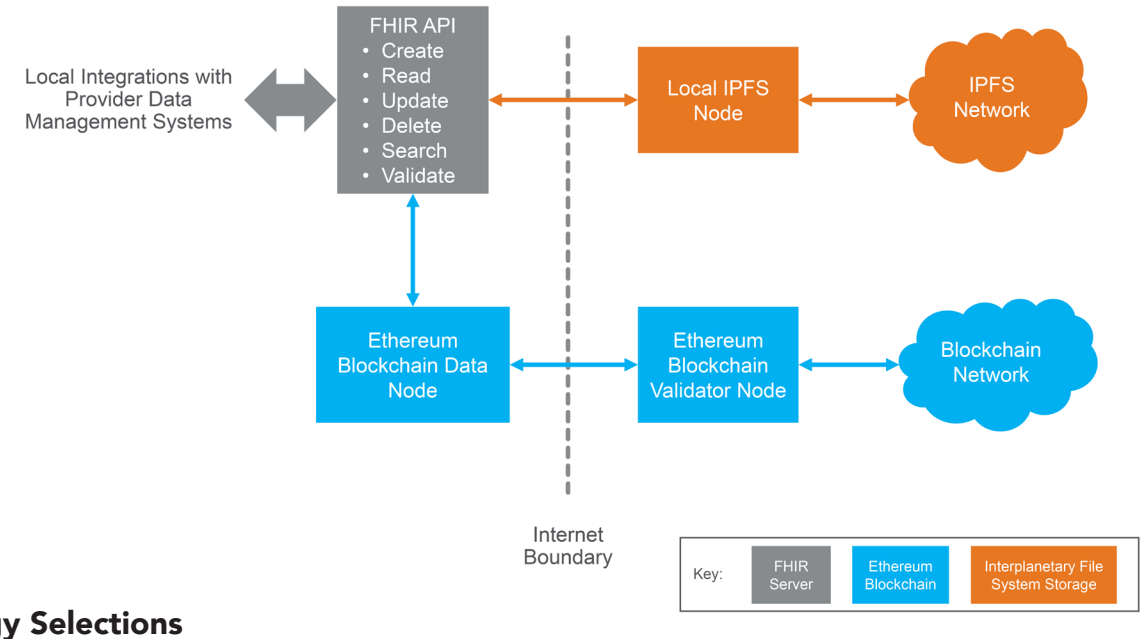
**Make integrations natural –** Blockchain technology is new to most organizations and we didn't want to impose a steep learning curve on our members. Our objective was to establish a healthcare standards-based approach to interacting with the blockchain to make it similar to interacting with other healthcare systems.

**Decentralize everything –** We embraced the decentralized spirit of blockchain technology and avoided creating centralized services that might introduce governance controlled by a single entity, scalability issues or reliability concerns.

**Deploy anywhere –** We sought to create a modular architecture capable of running in a variety of environments without dictating choices that could be contrary to the enterprise standards of our Alliance members.

**Anticipate future improvements –** The state of the art of blockchain technology is evolving fast and we wanted to future proof the utility architecture. We have made choices that anticipate the need for future flexibility and the ability to leverage emerging improvements in blockchain technology.

These principles have been used in the overall architecture and selection of technologies to implement the utility.




## Technology Selections

The Alliance strategically selected the open sourced Ethereum family of blockchain clients as the foundational technology after several architecture iterations. This choice was based on function, stability and performance testing as well as considerations for future proofing the architecture.

We decided to design an interoperable application programming interface based on the HL7® Fast Healthcare Interoperability Resource (HL7® FHIR®) standard to highly simplify the external system interactions with the utility. The FHIR API component orchestrates the interactions across the blockchain and the off-chain storage.

The architecture strives to decentralize as many components as possible, avoiding ownership, governance and reliability considerations that centralized choices may introduce. As a result, the off-chain storage is implemented with the Inter-Planetary File System (IPFS). The IPFS content identifier of data is indirectly referenced by transactions on the blockchain, maximizing the utilization of the blockchain while providing data sharing flexibility.

Decentralization is taken a step further as each Alliance member must deploy and maintain their own utility components. The architecture provides the flexibility for members to deploy their components based on their respective enterprise requirements. Some members have elected to deploy their components within their own data centers, while others are using secured public cloud services such as Amazon Web Services and Microsoft® Azure.

We choose the Ethereum client and consensus protocol with an eye toward the future. The current implementation uses the native Go Ethereum client with the Clique proof-of-authority consensus protocol. The Clique consensus protocol appears to be consistent with the future direction of Ethereum and should enable the support of additional clients in the future, improving the flexibility of our utility.

To learn more about the Synaptic Health Alliance,
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